INDIAN JOURNAL OF
ENGINEERING

19(51), 2022

Heterogeneous velocity and bacterial transport coefficient influence of Siprillum model in streams

Tom-Cyprian N[1], Eluozo, SN[2]

To Cite:
Tom-Cyprian N, Eluozo, SN. Heterogeneous velocity and bacterial transport coefficient influence of Siprillum model in streams. *Indian Journal of Engineering*, 2022, 19(51), 246-271

Author Affiliation:
[1]Department of Agricultural and Environmental Engineering, Faculty of Engineering, Rivers State University, Nigeria; Email; ndamzi.cyprian@ust.edu.ng
[2]Department of Civil Engineering, College of Engineering, Gregory University Uturu Abia State, Nigeria

Peer-Review History
Received: 18 March 2022
Reviewed & Revised: 20/March/2022 to 09/May/2022
Accepted: 11 May 2022
Published: 14 May 2022

Peer-Review Model
External peer-review was done through double-blind method.

ABSTRACT

This paper monitors the influence of heterogeneous velocity and bacteria transport coefficient influence on Siprillum model in streams, the study examined heterogeneous velocities in different station point of discharge, dispersion is another observed parameter that was investigated due the activities of man in the study environment, the biological waste are discharge at different location within the stream environment. The study through the require surveyor, examined the points of discharge in the stream; this was to determined significant parameters that could pressure the transport in its concentration at different point source of discharge. Bacterial transport coefficient were observed and monitored, its variation also were examined, its reflections on the concentrations were evaluated in the system, the stream from it examination deposit different temperature, this were reflected from the results observed through the analytical application from the derived model simulation values. The study reflected the pressure from the heterogeneity stream velocity, while temperature of the stream affected the concentration through its deposited variation, their rates of microbial deposition observed decreased in concentration with respect to increase in distance, these also were evaluated from the influential parameters, the highest distance experienced the lowest concentration of the microbes in all the figures, the predictive values were compared with experimental data, and both parameters developed best fits correlation, the study is imperative because the rate of heterogeneous in stream velocities has been examined, there reflection in concentrations levels has been evaluated, variation of temperature in stream reflecting the concentration has been observed, experts will definitely applied this concept as a benchmark in monitoring the transport of the Siprillum concentration in the stream environment.

Keywords: Heterogeneous, Velocity, Bacterial Siprillum Model and Stream

1. INTRODUCTION

The pollution of Pathogen has known to be a serious issue for almost all types of ambient water bodies (USEPA, 2012), experts has gain more understanding waterborne pathogen pollution in a relatively broader sense is imperative.

There are some scientific evidence that warm the Earth on it climatic conditions that has unequivocal (IPCC, 2007), it is imperative to comprehend how such changes in weather conditions or patterns develop potentially impact on *E. coli* levels in ambient water bodies. Base on factors it is necessary to meet the futures of water demand for food, such increasing water resource structures are imperative (Word Bank, 2010); The studies from World Health Organization (WHO), shows that over 2.6 billion people lack access to clean water, this bad condition is responsible for about 2.2 million deaths annually, of which 1.4 million are children (WHO, 2010). Improving water quality could reduce about 4% of the global disease burden (WHO, 2010). Reduction the number of people without safe drinking water should reduced by 50% by the years to come (WHO, 2011). There has been intensive study by Craun et al. (2006) such statistics on waterborne outbreaks in the U.S., which shows that at least 1870 outbreaks (23 per year) occurred between 1920 and 2002. These are due to such exposure on water-borne pathogens, (Arnone and Walling, 2007). Besides acute gastroenteritis, a most important etiological agent, numerous others such as *Giarida*, *Cryptosporadium*, *E. coli* O157:H7, *V. cholera*, and *Salmonella* were the grounds for many outbreaks (Craun et al., 2006). In mid and late 18th century diseases such as cholera, infected millions of people all over the world (Colwell, 1996, Weiskelet al., 1996; Arnone and Walling, 2007 Jamieson et al 202).

Jamieson et al. (2004), Gerba and Smith (2005), Gerba and McLeod (1976), John and Rose (2005), Hipsey et al. (2008), and Pachepsky and Shelton (2011) thoroughly reviewed current works done on the state of art and advancement in this field, predominantly, mosly on freshwater and that of estuarine sediments. However, there has been some knowledge gap in studies. in addition this, several current reviews on going on specific water bodies, for instance, John and Rose (2005) focuses on ground water, Brookes (2004) focuses on reservoirs and lakes, and Jamieson et al. (2004)currently the present day latest concept has been developed, it has also expand on agriculture watershed. Others, for example, Kay et al. (2007, 2008) reviewed on catchment microbial dynamics.

2. THEORETICAL BACKGROUND

$$\frac{dc}{dx} + \beta(x)K = A(x) \quad \ldots\ldots \quad 1$$

Multiplying the equation through by $C[x]$, we have:

$$C(x)\frac{dC}{dx} + C(x)\beta(x)K = C(x)A(x) \quad \ldots\ldots \quad 2$$

Let $P(x) = C(x)\beta(x)$ 3

Then Equation (2), we have:

$$C(x)\frac{dC}{dx} + C(x)\beta(x)K = C(x)A(x) \quad \ldots\ldots \quad 4$$

$$C(x)\frac{dC}{dx} + P(x)K = C(x)A(x) \quad \ldots\ldots \quad 5$$

$$\boxed{C(x)P^1 + P(x)K = C(x)A(x)} \quad \ldots\ldots \quad 6$$

$$C(x)P^1 = C(x)A - P(x)K \quad \ldots\ldots \quad 7$$

Differentiate 2nd term on the left hand side of(6) with respect to x, we have

$$K\frac{dC}{dx}=C(x)A(x)-C(x)P^{1} \qquad \text{8}$$

$$\frac{dC}{dx}=\frac{1}{K}\left[C(x)A(x)-C(x)P^{1}\right] \qquad \text{9}$$

$$\frac{dC}{dx}=\frac{C(x)}{K}\left[A(x)-P^{1}\right] \qquad \text{10}$$

Applying separation of variables, by dividing through by C(x) and cross multiply by dx, gives:

$$\frac{dC}{C}=\frac{1}{K}\left[A(x)-P^{1}\right]dx \qquad \text{11}$$

$$\frac{1}{C(x)}dC=\frac{1}{K}\left[A(x)-P^{1}\right]dx \qquad \text{12}$$

$$\frac{1}{C(x)}dC=\left(\frac{A(x)}{K}-\frac{P^{1}}{K}\right)dx \qquad \text{13}$$

$$\int\frac{1}{C(x)}dC=\int\left(\frac{A(x)}{K}-\frac{P^{1}}{K}\right)dx+\eta \qquad \text{14}$$

$$\ln C(x)=\int A(x)dx-\int\frac{P^{1}}{K}dx+\eta \qquad \text{15}$$

$$\ln C(x)=\frac{1}{K}\left[Ax-P^{1}\right]x+\eta \qquad \text{16}$$

$$\ln C(x)=\left(\frac{A(x)}{K}-\frac{P^{1}}{K}\right)x+\eta \qquad \text{17}$$

Taking exponent of the both side of the equation

$$C(x)=\ell^{\left(\frac{A(x)}{K}-\frac{P^{1}}{K}+\eta\right)} \qquad \text{18}$$

$$C(x)=D\ell^{\frac{1}{K}\left(Ax-P^{1}x\right)} \qquad \text{19}$$

3. MATERIAL AND METHOD

Standard laboratory experiment where performed to monitor Siprillum using the standard method for the experiment at different sample at different station, the water sample were collected in sequences based on specification stipulated at different locations, this samples collected at different location generated variations at different distance producing different Siprillum concentration through physiochemical analysis, the experimental result were compared with the theoretical values for model validation.

4. RESULT AND DISCUSSION

Table 1: Predictive and Experimental Values of Siprillum Concentration at Different Distance

Distance [x]	Predictive Values of Siprillum Concentration.[Mg/L] Variation on Bacterial Transport Coefficient [27.5]	Experimental Values of Siprillum Concentration .[Mg/L] Variation on Bacterial Transport Coefficient [27.5]
2	22.12147864	22.116
4	22.10596816	22.102
6	22.09046856	22.088
8	22.07497983	22.074
10	22.05950195	22.06
12	22.04403493	22.046
14	22.02857875	22.032
16	22.01313341	22.018
18	21.9976989	22.004
20	21.98227522	21.99
22	21.96686234	21.976
24	21.95146027	21.962
26	21.93606901	21.948
28	21.92068853	21.934
30	21.90531884	21.92
32	21.88995992	21.906
34	21.87461177	21.892
38	21.84394775	21.864
40	21.82863187	21.85
42	21.81332672	21.836
44	21.7980323	21.822
46	21.78274861	21.808
48	21.76747564	21.794
50	21.75221337	21.78
54	21.72172093	21.752
56	21.70649074	21.738
58	21.69127123	21.724
60	21.6760624	21.71
62	21.66086422	21.696
64	21.64567671	21.682
66	21.63049984	21.668
68	21.61533361	21.654
70	21.60017802	21.64
72	21.58503305	21.626
74	21.5698987	21.612

76	21.55477497	21.598
78	21.53966184	21.584
80	21.5245593	21.57
82	21.50946735	21.556
84	21.49438599	21.542
86	21.4793152	21.528
88	21.46425497	21.514
90	21.44920531	21.5

Table 2: Predictive and Experimental Values of Siprillum Concentration at Different Distance

Distance [x]	Predictive Values of Siprillum Concentration.[Mg/L] Variation on Bacterial Transport Coefficient [27.5]	Experimental Values of Siprillum Concentration .[Mg/L] Variation on Bacterial Transport Coefficient [27.5]
2	0.265457744	0.26482
4	0.265271618	0.26464
6	0.265085623	0.26446
8	0.264899758	0.26428
10	0.264714023	0.2641
12	0.264528419	0.26392
14	0.264342945	0.26374
16	0.264157601	0.26356
18	0.263972387	0.26338
20	0.263787303	0.2632
22	0.263602348	0.26302
24	0.263417523	0.26284
26	0.263232828	0.26266
28	0.263048262	0.26248
30	0.262863826	0.2623
32	0.262679519	0.26212
34	0.262495341	0.26194
38	0.262127373	0.26158
40	0.261943582	0.2614
42	0.261759921	0.26122
44	0.261576388	0.26104
46	0.261392983	0.26086
48	0.261209708	0.26068
50	0.26102656	0.2605
54	0.260660651	0.26014
56	0.260477889	0.25996
58	0.260295255	0.25978

60	0.260112749	0.2596
62	0.259930371	0.25942
64	0.25974812	0.25924
66	0.259565998	0.25906
68	0.259384003	0.25888
70	0.259202136	0.2587
72	0.259020397	0.25852
74	0.258838784	0.25834
76	0.2586573	0.25816
78	0.258475942	0.25798
80	0.258294712	0.2578
82	0.258113608	0.25762
84	0.257932632	0.25744
86	0.257751782	0.25726
88	0.25757106	0.25708
90	0.257390464	0.2569

Table 3: Predictive and Experimental Values of Siprillum Concentration at Different Distance

Distance [x]	Predictive Values of Siprillum Concentration.[Mg/L] Variation on Bacterial Transport Coefficient [26.5]	Experimental Values of Siprillum Concentration .[Mg/L] Variation on Bacterial Transport Coefficient [26.5]
2	22.12089503	22.116
4	22.10480177	22.102
6	22.08872023	22.088
8	22.07265038	22.074
10	22.05659223	22.06
12	22.04054575	22.046
14	22.02451095	22.032
16	22.00848782	22.018
18	21.99247634	22.004
20	21.97647652	21.99
22	21.96048833	21.976
24	21.94451177	21.962
26	21.92854684	21.948
28	21.91259352	21.934
30	21.89665181	21.92
32	21.8807217	21.906
34	21.86480317	21.892
38	21.83300086	21.864
40	21.81711705	21.85

42	21.8012448	21.836
44	21.78538409	21.822
46	21.76953493	21.808
48	21.75369729	21.794
50	21.73787118	21.78
54	21.70625349	21.752
56	21.69046189	21.738
58	21.67468178	21.724
60	21.65891315	21.71
62	21.643156	21.696
64	21.6274103	21.682
66	21.61167607	21.668
68	21.59595328	21.654
70	21.58024193	21.64
72	21.564542	21.626
74	21.5488535	21.612
76	21.53317642	21.598
78	21.51751074	21.584
80	21.50185645	21.57
82	21.48621356	21.556
84	21.47058204	21.542
86	21.4549619	21.528
88	21.43935312	21.514
90	21.4237557	21.5

Table 4: Predictive and Experimental Values of Siprillum Concentration at Different Distance

Distance [x]	Predictive Values of Siprillum Concentration.[Mg/L] Variation on Bacterial Transport Coefficient [24.15]	Experimental Values of Siprillum Concentration .[Mg/L] Variation on Bacterial Transport Coefficient [24.15]
2	0.265431332	0.26536
4	0.265218834	0.26518
6	0.265006507	0.265
8	0.264794349	0.26482
10	0.264582361	0.26464
12	0.264370543	0.26446
14	0.264158894	0.26428
16	0.263947415	0.2641
18	0.263736106	0.26392
20	0.263524965	0.26374

22	0.263313993	0.26356
24	0.263103191	0.26338
26	0.262892557	0.2632
28	0.262682092	0.26302
30	0.262471795	0.26284
32	0.262261666	0.26266
34	0.262051706	0.26248
38	0.26163229	0.26212
40	0.261422834	0.26194
42	0.261213545	0.26176
44	0.261004424	0.26158
46	0.26079547	0.2614
48	0.260586684	0.26122
50	0.260378064	0.26104
54	0.259961327	0.26068
56	0.259753208	0.2605
58	0.259545256	0.26032
60	0.259337471	0.26014
62	0.259129851	0.25996
64	0.258922399	0.25978
66	0.258715112	0.2596
68	0.258507991	0.25942
70	0.258301036	0.25924
72	0.258094246	0.25906
74	0.257887622	0.25888
76	0.257681164	0.2587
78	0.257474871	0.25852
80	0.257268743	0.25834
82	0.25706278	0.25816
84	0.256856982	0.25798
86	0.256651348	0.2578
88	0.25644588	0.25762
90	0.256240575	0.25744

Table 5: Predictive and Experimental Values of Siprillum Concentration at Different Distance

Distance [x]	Predictive Values of Siprillum Concentration.[Mg/L] Variation on Bacterial Transport Coefficient [22.15]	Experimental Values of Siprillum Concentration .[Mg/L] Variation on Bacterial Transport Coefficient [22.15]
2	0.265412145	0.26536121
4	0.265180493	0.26518121

6	0.264949043	0.26500121
8	0.264717794	0.26482121
10	0.264486748	0.26464121
12	0.264255903	0.26446121
14	0.26402526	0.26428121
16	0.263794818	0.26410121
18	0.263564578	0.26392121
20	0.263334538	0.26374121
22	0.263104699	0.26356121
24	0.26287506	0.26338121
26	0.262645622	0.26320121
28	0.262416385	0.26302121
30	0.262187347	0.26284121
32	0.261958509	0.26266121
34	0.261729871	0.26248121
38	0.261273193	0.26212121
40	0.261045154	0.26194121
42	0.260817313	0.26176121
44	0.260589671	0.26158121
46	0.260362227	0.26140121
48	0.260134983	0.26122121
50	0.259907936	0.26104121
54	0.259454438	0.26068121
56	0.259227985	0.26050121
58	0.25900173	0.26032121
60	0.258775673	0.26014121
62	0.258549813	0.25996121
64	0.25832415	0.25978121
66	0.258098684	0.25960121
68	0.257873415	0.25942121
70	0.257648342	0.25924121
72	0.257423466	0.25906121
74	0.257198786	0.25888121
76	0.256974302	0.25870121
78	0.256750015	0.25852121
80	0.256525923	0.25834121
82	0.256302026	0.25816121
84	0.256078325	0.25798121
86	0.255854819	0.25780121
88	0.255631509	0.25762121
90	0.255408393	0.25744121

Table 6: Predictive and Experimental Values of Siprillum Concentration at Different Distance

Depth [m]	Predictive Values of Siprillum Concentration.[Mg/L] Variation on Bacterial Transport Coefficient [27.5]	Experimental Values of Siprillum Concentration .[Mg/L] Variation on Bacterial Transport Coefficient [27.5]
0.1	22.13622367	22.13552367
0.11	22.13614604	22.13545367
0.12	22.13606841	22.13538367
0.13	22.13599078	22.13531367
0.14	22.13591315	22.13524367
0.15	22.13583552	22.13517367
0.16	22.13575789	22.13510367
0.17	22.13568026	22.13503367
0.18	22.13560263	22.13496367
0.19	22.135525	22.13489367
0.2	22.13544737	22.13482367
0.21	22.13536975	22.13475367
0.22	22.13529212	22.13468367
0.23	22.13521449	22.13461367
0.24	22.13513686	22.13454367
0.25	22.13505923	22.13447367
0.26	22.13498161	22.13440367
0.27	22.13490398	22.13433367
0.28	22.13482635	22.13426367
0.3	22.1346711	22.13412367
0.31	22.13459348	22.13405367
0.32	22.13451585	22.13398367
0.33	22.13443823	22.13391367
0.34	22.1343606	22.13384367
0.35	22.13428298	22.13377367
0.36	22.13420535	22.13370367
0.37	22.13412773	22.13363367
0.38	22.1340501	22.13356367
0.39	22.13397248	22.13349367
0.4	22.13389486	22.13342367
0.41	22.13381723	22.13335367
0.42	22.13373961	22.13328367
0.43	22.13366199	22.13321367
0.44	22.13358437	22.13314367
0.55	22.13273054	22.13237367
0.56	22.13265292	22.13230367

0.57	22.1325753	22.13223367
0.58	22.13249768	22.13216367
0.59	22.13242007	22.13209367
0.6	22.13234245	22.13202367
0.61	22.13226483	22.13195367
0.62	22.13218721	22.13188367
0.63	22.1321096	22.13181367
0.64	22.13203198	22.13174367
0.65	22.13195436	22.13167367
0.66	22.13187675	22.13160367
0.67	22.13179913	22.13153367
0.68	22.13172152	22.13146367
0.69	22.1316439	22.13139367
0.7	22.13156629	22.13132367
0.71	22.13148867	22.13125367
0.72	22.13141106	22.13118367
0.73	22.13133344	22.13111367
0.74	22.13125583	22.13104367
0.75	22.13117821	22.13097367
0.79	22.13086776	22.13069367
0.8	22.13079015	22.13062367
0.81	22.13071254	22.13055367
0.82	22.13063493	22.13048367
0.83	22.13055731	22.13041367
0.9	22.13001404	22.12992367
0.91	22.12993643	22.12985367
0.92	22.12985882	22.12978367
0.93	22.12978121	22.12971367
0.94	22.12970361	22.12964367
0.95	22.129626	22.12957367
0.96	22.12954839	22.12950367
0.97	22.12947078	22.12943367
0.98	22.12939317	22.12936367
1	22.12923796	22.12922367
1.2	22.12768588	22.12782367
1.25	22.12729787	22.12747367
1.3	22.12690988	22.12712367
1.35	22.12652189	22.12677367
1.4	22.12613391	22.12642367

Table 7: Predictive and Experimental Values of Siprillum Concentration at Different Distance

Depth [m]	Predictive Values of Siprillum Concentration.[Mg/L] Variation on Bacterial Transport Coefficient [27.5]	Experimental Values of Siprillum Concentration .[Mg/L] Variation on Bacterial Transport Coefficient [27.5]
0.1	0.265634684	0.265625684
0.11	0.265633753	0.265624784
0.12	0.265632821	0.265623884
0.13	0.265631889	0.265622984
0.14	0.265630958	0.265622084
0.15	0.265630026	0.265621184
0.16	0.265629095	0.265620284
0.17	0.265628163	0.265619384
0.18	0.265627232	0.265618484
0.19	0.2656263	0.265617584
0.2	0.265625368	0.265616684
0.21	0.265624437	0.265615784
0.22	0.265623505	0.265614884
0.23	0.265622574	0.265613984
0.24	0.265621642	0.265613084
0.25	0.265620711	0.265612184
0.26	0.265619779	0.265611284
0.27	0.265618848	0.265610384
0.28	0.265617916	0.265609484
0.3	0.265616053	0.265607684
0.31	0.265615122	0.265606784
0.32	0.26561419	0.265605884
0.33	0.265613259	0.265604984
0.34	0.265612327	0.265604084
0.35	0.265611396	0.265603184
0.36	0.265610464	0.265602284
0.37	0.265609533	0.265601384
0.38	0.265608601	0.265600484
0.39	0.26560767	0.265599584
0.4	0.265606738	0.265598684
0.41	0.265605807	0.265597784
0.42	0.265604875	0.265596884
0.43	0.265603944	0.265595984
0.44	0.265603012	0.265595084
0.55	0.265592766	0.265585184
0.56	0.265591835	0.265584284

0.57	0.265590904	0.265583384
0.58	0.265589972	0.265582484
0.59	0.265589041	0.265581584
0.6	0.265588109	0.265580684
0.61	0.265587178	0.265579784
0.62	0.265586247	0.265578884
0.63	0.265585315	0.265577984
0.64	0.265584384	0.265577084
0.65	0.265583452	0.265576184
0.66	0.265582521	0.265575284
0.67	0.26558159	0.265574384
0.68	0.265580658	0.265573484
0.69	0.265579727	0.265572584
0.7	0.265578795	0.265571684
0.71	0.265577864	0.265570784
0.72	0.265576933	0.265569884
0.73	0.265576001	0.265568984
0.74	0.26557507	0.265568084
0.75	0.265574139	0.265567184
0.79	0.265570413	0.265563584
0.8	0.265569482	0.265562684
0.81	0.26556855	0.265561784
0.82	0.265567619	0.265560884
0.83	0.265566688	0.265559984
0.9	0.265560168	0.265553684
0.91	0.265559237	0.265552784
0.92	0.265558306	0.265551884
0.93	0.265557375	0.265550984
0.94	0.265556443	0.265550084
0.95	0.265555512	0.265549184
0.96	0.265554581	0.265548284
0.97	0.265553649	0.265547384
0.98	0.265552718	0.265546484
1	0.265550856	0.265544684
1.2	0.265532231	0.265526684
1.25	0.265527574	0.265522184
1.3	0.265522919	0.265517684
1.35	0.265518263	0.265513184
1.4	0.265513607	0.265508684

Table 8: Predictive and Experimental Values of Siprillum Concentration at Different Distance

Depth [m]	Predictive Values of Siprillum Concentration.[Mg/L] Variation on Bacterial Transport Coefficient [26.5]	Experimental Values of Siprillum Concentration .[Mg/L] Variation on Bacterial Transport Coefficient [26.5]
0.1	22.13619447	22.13549447
0.11	22.13611392	22.13542447
0.12	22.13603337	22.13535447
0.13	22.13595282	22.13528447
0.14	22.13587227	22.13521447
0.15	22.13579172	22.13514447
0.16	22.13571117	22.13507447
0.17	22.13563062	22.13500447
0.18	22.13555007	22.13493447
0.19	22.13546952	22.13486447
0.2	22.13538898	22.13479447
0.21	22.13530843	22.13472447
0.22	22.13522788	22.13465447
0.23	22.13514733	22.13458447
0.24	22.13506678	22.13451447
0.25	22.13498624	22.13444447
0.26	22.13490569	22.13437447
0.27	22.13482514	22.13430447
0.28	22.1347446	22.13423447
0.3	22.13458351	22.13409447
0.31	22.13450296	22.13402447
0.32	22.13442242	22.13395447
0.33	22.13434187	22.13388447
0.34	22.13426133	22.13381447
0.35	22.13418078	22.13374447
0.36	22.13410024	22.13367447
0.37	22.1340197	22.13360447
0.38	22.13393915	22.13353447
0.39	22.13385861	22.13346447
0.4	22.13377807	22.13339447
0.41	22.13369753	22.13332447
0.42	22.13361698	22.13325447
0.43	22.13353644	22.13318447
0.44	22.1334559	22.13311447
0.55	22.13256996	22.13234447
0.56	22.13248943	22.13227447

0.57	22.13240889	22.13220447
0.58	22.13232835	22.13213447
0.59	22.13224781	22.13206447
0.6	22.13216728	22.13199447
0.61	22.13208674	22.13192447
0.62	22.13200621	22.13185447
0.63	22.13192567	22.13178447
0.64	22.13184513	22.13171447
0.65	22.1317646	22.13164447
0.66	22.13168406	22.13157447
0.67	22.13160353	22.13150447
0.68	22.13152299	22.13143447
0.69	22.13144246	22.13136447
0.7	22.13136193	22.13129447
0.71	22.13128139	22.13122447
0.72	22.13120086	22.13115447
0.73	22.13112033	22.13108447
0.74	22.13103979	22.13101447
0.75	22.13095926	22.13094447
0.79	22.13063714	22.13066447
0.8	22.13055661	22.13059447
0.81	22.13047607	22.13052447
0.82	22.13039554	22.13045447
0.83	22.13031501	22.13038447
0.9	22.12975131	22.12989447
0.91	22.12967079	22.12982447
0.92	22.12959026	22.12975447
0.93	22.12950973	22.12968447
0.94	22.1294292	22.12961447
0.95	22.12934868	22.12954447
0.96	22.12926815	22.12947447
0.97	22.12918763	22.12940447
0.98	22.1291071	22.12933447
1	22.12894605	22.12919447
1.2	22.12733561	22.12779447
1.25	22.12693302	22.12744447
1.3	22.12653044	22.12709447
1.35	22.12612786	22.12674447
1.4	22.12572529	22.12639447

Table 9: Predictive and Experimental Values of Siprillum Concentration at Different Distance

Depth [m]	Predictive Values of Siprillum Concentration.[Mg/L] Variation on Bacterial Transport Coefficient [22.15]	Experimental Values of Siprillum Concentration .[Mg/L] Variation on Bacterial Transport Coefficient [22.15]
0.1	0.265632402	0.265623402
0.11	0.265631243	0.265622502
0.12	0.265630083	0.265621602
0.13	0.265628923	0.265620702
0.14	0.265627764	0.265619802
0.15	0.265626604	0.265618902
0.16	0.265625444	0.265618002
0.17	0.265624284	0.265617102
0.18	0.265623125	0.265616202
0.19	0.265621965	0.265615302
0.2	0.265620805	0.265614402
0.21	0.265619646	0.265613502
0.22	0.265618486	0.265612602
0.23	0.265617326	0.265611702
0.24	0.265616167	0.265610802
0.25	0.265615007	0.265609902
0.26	0.265613847	0.265609002
0.27	0.265612688	0.265608102
0.28	0.265611528	0.265607202
0.3	0.265609209	0.265605402
0.31	0.265608049	0.265604502
0.32	0.26560689	0.265603602
0.33	0.26560573	0.265602702
0.34	0.26560457	0.265601802
0.35	0.265603411	0.265600902
0.36	0.265602251	0.265600002
0.37	0.265601092	0.265599102
0.38	0.265599932	0.265598202
0.39	0.265598772	0.265597302
0.4	0.265597613	0.265596402
0.41	0.265596453	0.265595502
0.42	0.265595294	0.265594602
0.43	0.265594134	0.265593702
0.44	0.265592975	0.265592802
0.55	0.26558022	0.265582902
0.56	0.26557906	0.265582002

0.57	0.265577901	0.265581102
0.58	0.265576741	0.265580202
0.59	0.265575582	0.265579302
0.6	0.265574422	0.265578402
0.61	0.265573263	0.265577502
0.62	0.265572103	0.265576602
0.63	0.265570944	0.265575702
0.64	0.265569784	0.265574802
0.65	0.265568625	0.265573902
0.66	0.265567466	0.265573002
0.67	0.265566306	0.265572102
0.68	0.265565147	0.265571202
0.69	0.265563987	0.265570302
0.7	0.265562828	0.265569402
0.71	0.265561668	0.265568502
0.72	0.265560509	0.265567602
0.73	0.26555935	0.265566702
0.74	0.26555819	0.265565802
0.75	0.265557031	0.265564902
0.79	0.265552393	0.265561302
0.8	0.265551234	0.265560402
0.81	0.265550074	0.265559502
0.82	0.265548915	0.265558602
0.83	0.265547756	0.265557702
0.9	0.26553964	0.265551402
0.91	0.265538481	0.265550502
0.92	0.265537322	0.265549602
0.93	0.265536162	0.265548702
0.94	0.265535003	0.265547802
0.95	0.265533844	0.265546902
0.96	0.265532684	0.265546002
0.97	0.265531525	0.265545102
0.98	0.265530366	0.265544202
1	0.265528047	0.265542402
1.2	0.265504863	0.265524402
1.25	0.265499067	0.265519902
1.3	0.265493271	0.265515402
1.35	0.265487476	0.265510902
1.4	0.26548168	0.265506402

Table 10: Predictive and Experimental Values of Siprillum Concentration at Different Distance

Depth [m]	Predictive Values of Siprillum Concentration.[Mg/L] Variation on Bacterial Transport Coefficient [24.15]	Experimental Values of Siprillum Concentration .[Mg/L] Variation on Bacterial Transport Coefficient [24.15]
0.1	0.265633363	0.265624363
0.11	0.265632299	0.265623463
0.12	0.265631235	0.265622563
0.13	0.265630171	0.265621663
0.14	0.265629108	0.265620763
0.15	0.265628044	0.265619863
0.16	0.26562698	0.265618963
0.17	0.265625917	0.265618063
0.18	0.265624853	0.265617163
0.19	0.265623789	0.265616263
0.2	0.265622726	0.265615363
0.21	0.265621662	0.265614463
0.22	0.265620598	0.265613563
0.23	0.265619535	0.265612663
0.24	0.265618471	0.265611763
0.25	0.265617407	0.265610863
0.26	0.265616344	0.265609963
0.27	0.26561528	0.265609063
0.28	0.265614216	0.265608163
0.3	0.265612089	0.265606363
0.31	0.265611025	0.265605463
0.32	0.265609962	0.265604563
0.33	0.265608898	0.265603663
0.34	0.265607834	0.265602763
0.35	0.265606771	0.265601863
0.36	0.265605707	0.265600963
0.37	0.265604644	0.265600063
0.38	0.26560358	0.265599163
0.39	0.265602516	0.265598263
0.4	0.265601453	0.265597363
0.41	0.265600389	0.265596463
0.42	0.265599326	0.265595563
0.43	0.265598262	0.265594663
0.44	0.265597198	0.265593763
0.55	0.265585499	0.265583863
0.56	0.265584436	0.265582963

0.57	0.265583372	0.265582063
0.58	0.265582309	0.265581163
0.59	0.265581245	0.265580263
0.6	0.265580182	0.265579363
0.61	0.265579118	0.265578463
0.62	0.265578055	0.265577563
0.63	0.265576991	0.265576663
0.64	0.265575928	0.265575763
0.65	0.265574864	0.265574863
0.66	0.265573801	0.265573963
0.67	0.265572737	0.265573063
0.68	0.265571674	0.265572163
0.69	0.26557061	0.265571263
0.7	0.265569547	0.265570363
0.71	0.265568483	0.265569463
0.72	0.26556742	0.265568563
0.73	0.265566356	0.265567663
0.74	0.265565293	0.265566763
0.75	0.26556423	0.265565863
0.79	0.265559976	0.265562263
0.8	0.265558912	0.265561363
0.81	0.265557849	0.265560463
0.82	0.265556786	0.265559563
0.83	0.265555722	0.265558663
0.9	0.265548278	0.265552363
0.91	0.265547215	0.265551463
0.92	0.265546152	0.265550563
0.93	0.265545088	0.265549663
0.94	0.265544025	0.265548763
0.95	0.265542961	0.265547863
0.96	0.265541898	0.265546963
0.97	0.265540835	0.265546063
0.98	0.265539771	0.265545163
1	0.265537645	0.265543363
1.2	0.265516379	0.265525363
1.25	0.265511063	0.265520863
1.3	0.265505746	0.265516363
1.35	0.26550043	0.265511863
1.4	0.265495115	0.265507363

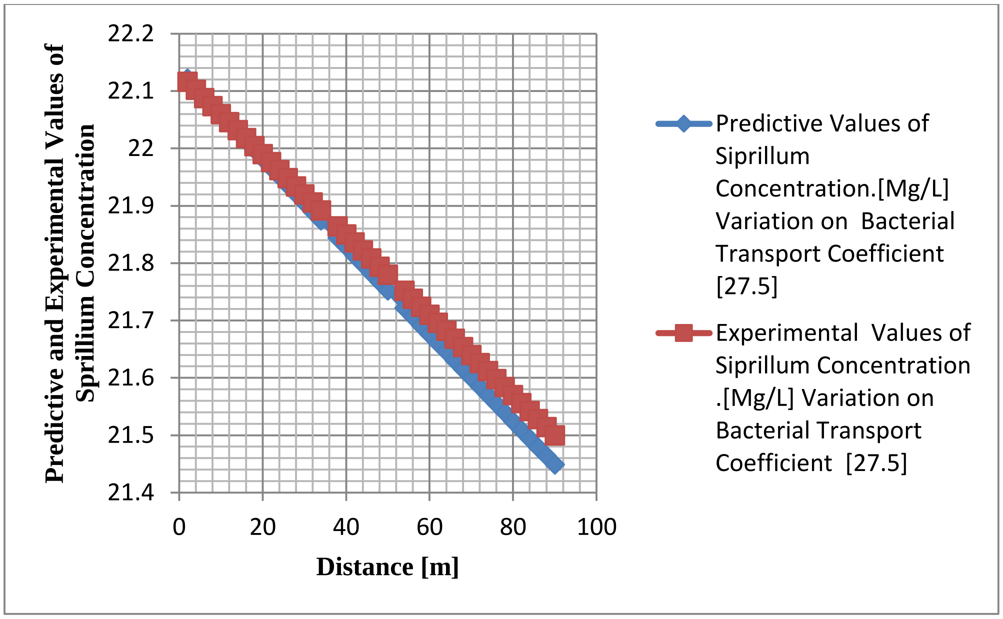

Figure 1: Predictive and Experimental Values of Siprillum Concentration at Different Distance

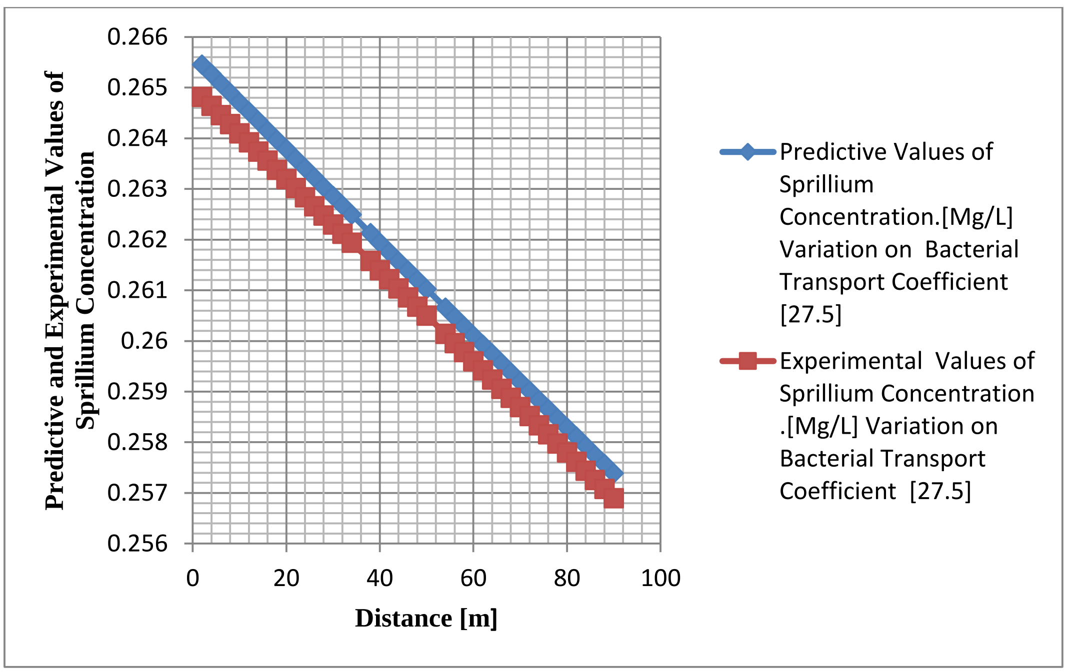

Figure 2: Predictive and Experimental Values of Siprillum Concentration at Different Distance

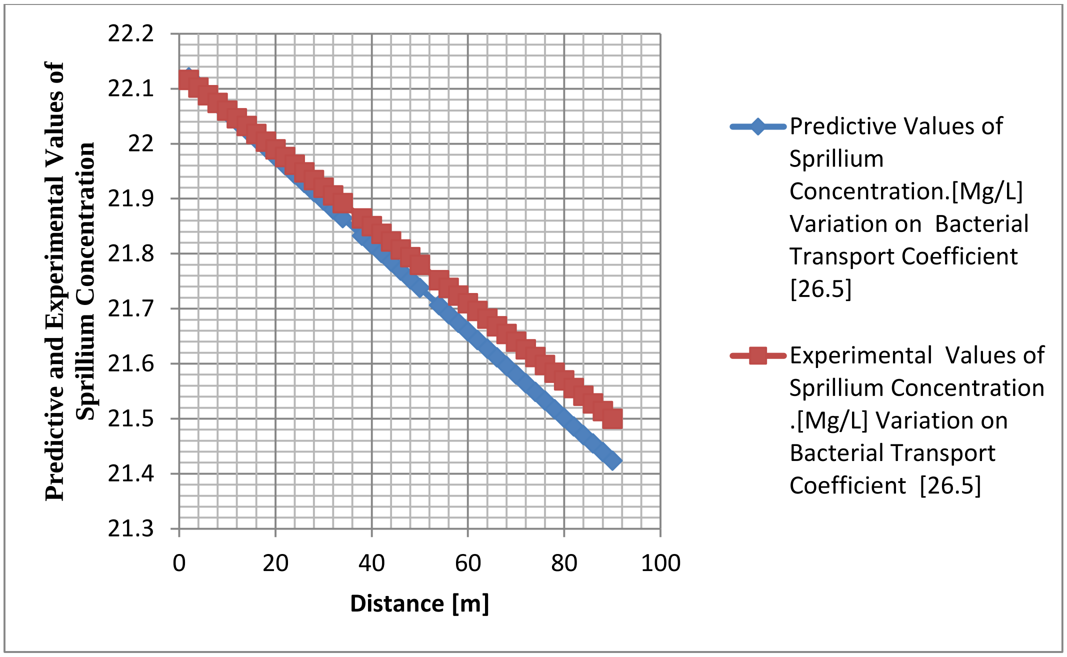

Figure 3: Predictive and Experimental Values of Siprillum Concentration at Different Distance

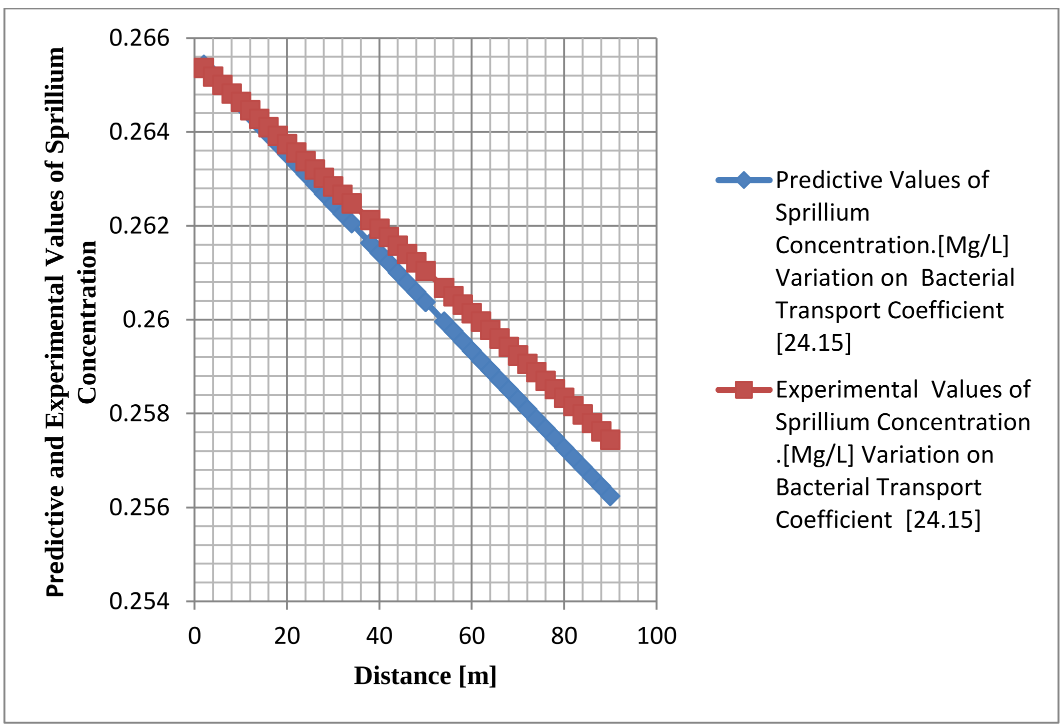

Figure 4: Predictive and Experimental Values of Siprillum Concentration at Different Distance

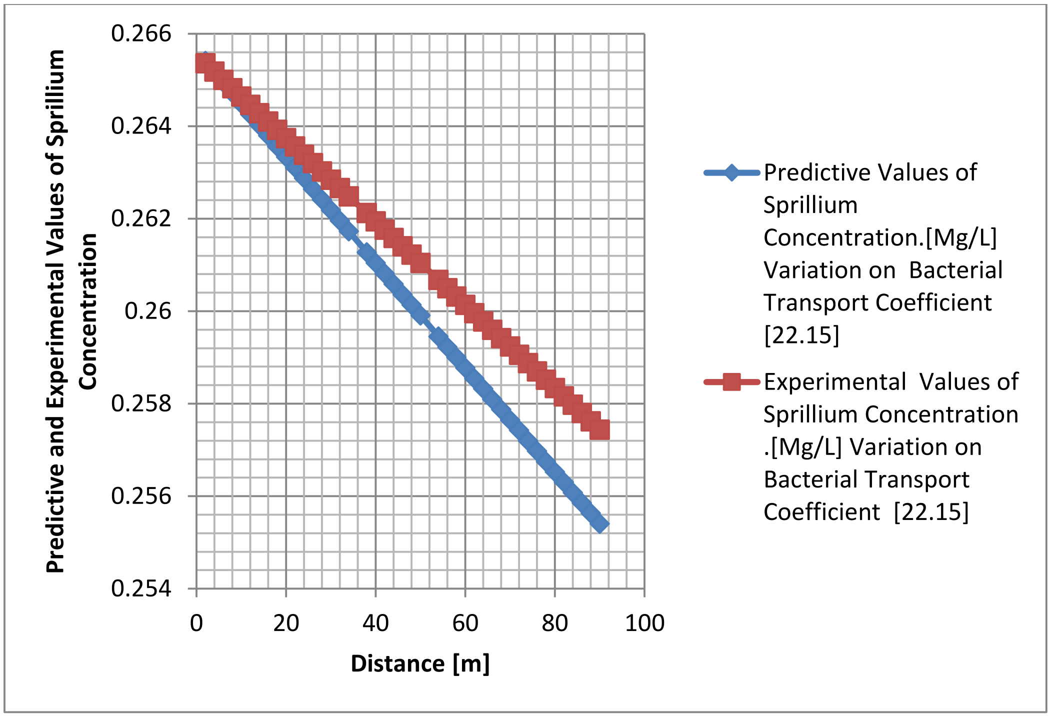

Figure 5: Predictive and Experimental Values of Siprillum Concentration at Different Distance

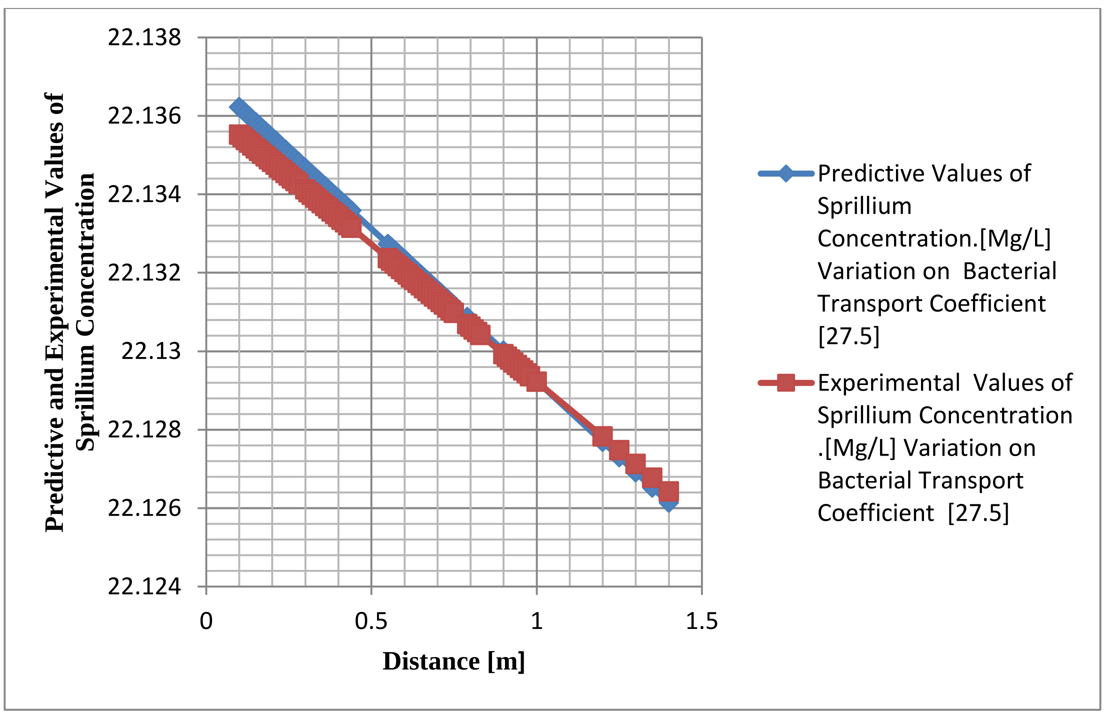

Figure 6: Predictive and Experimental Values of Siprillum Concentration at Different Distance

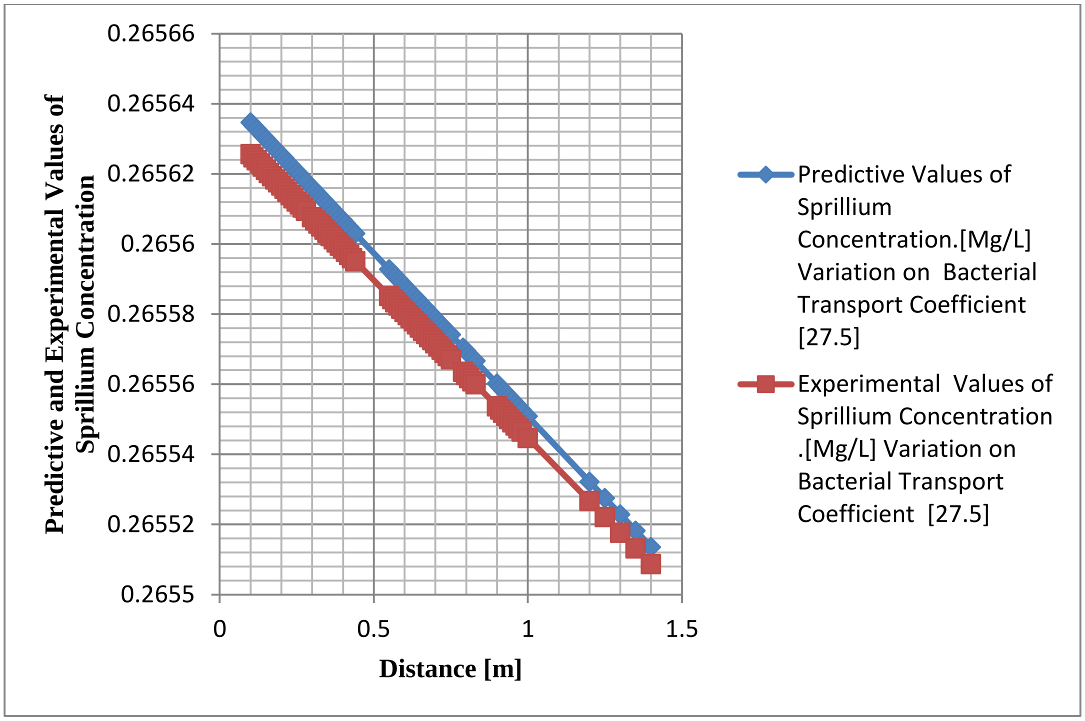

Figure 7: Predictive and Experimental Values of Siprillum Concentration at Different Distance

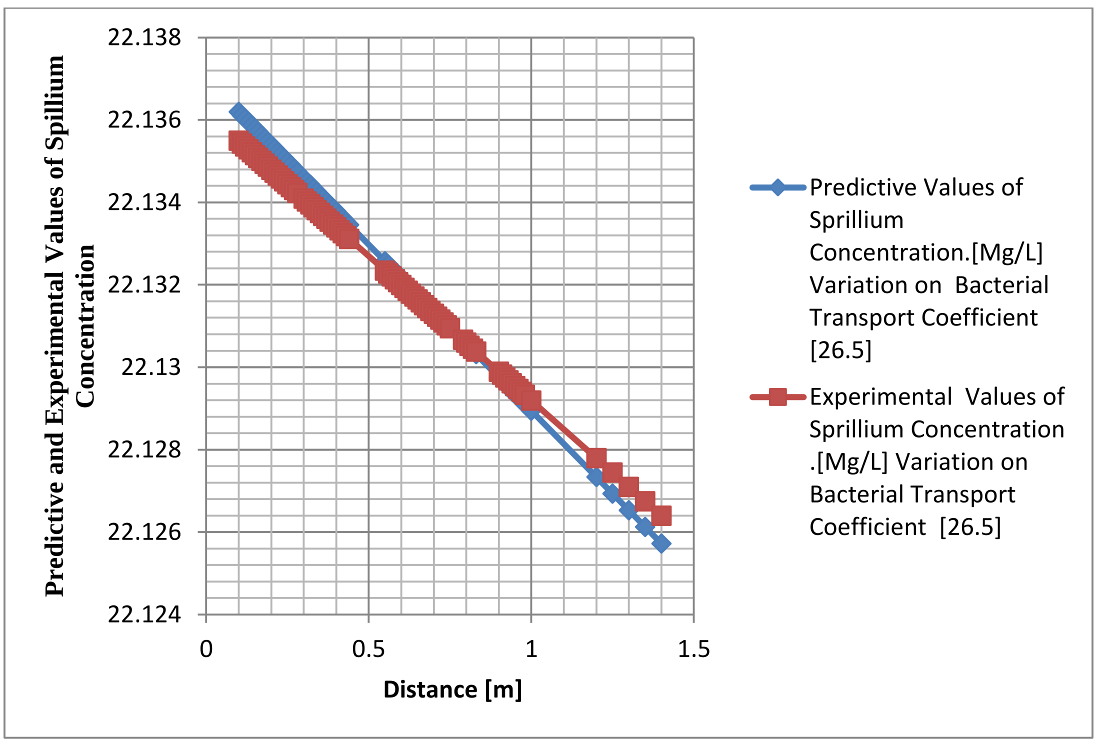

Figure 8: Predictive and Experimental Values of Siprillum Concentration at Different Distance

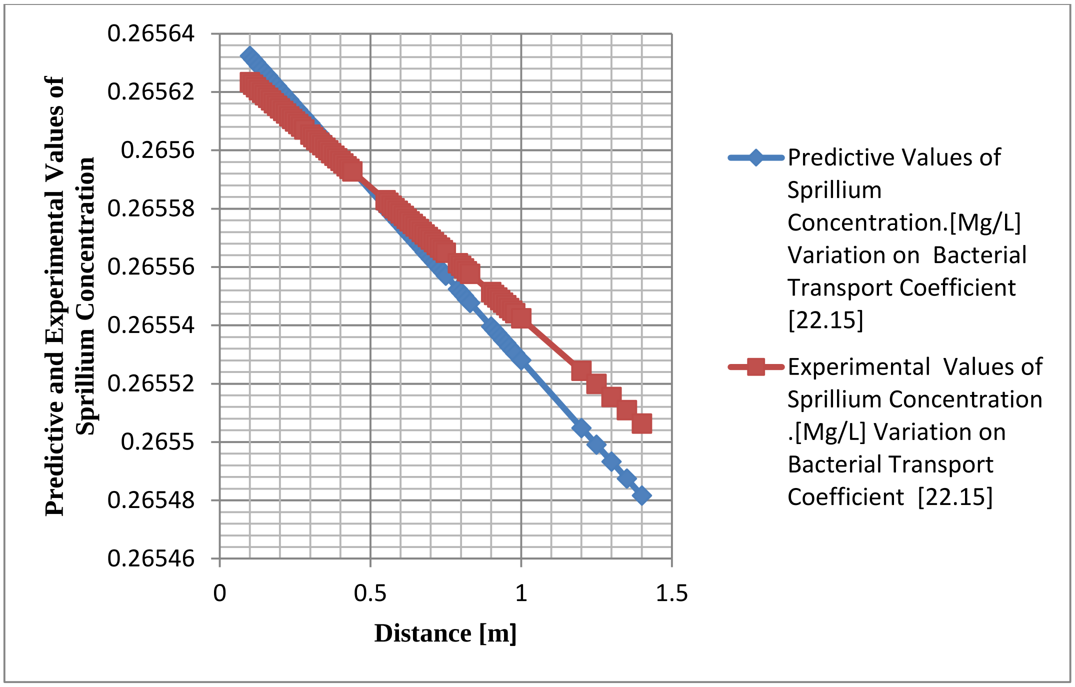

Figure 9: Predictive and Experimental Values of Siprillum Concentration at Different Distance

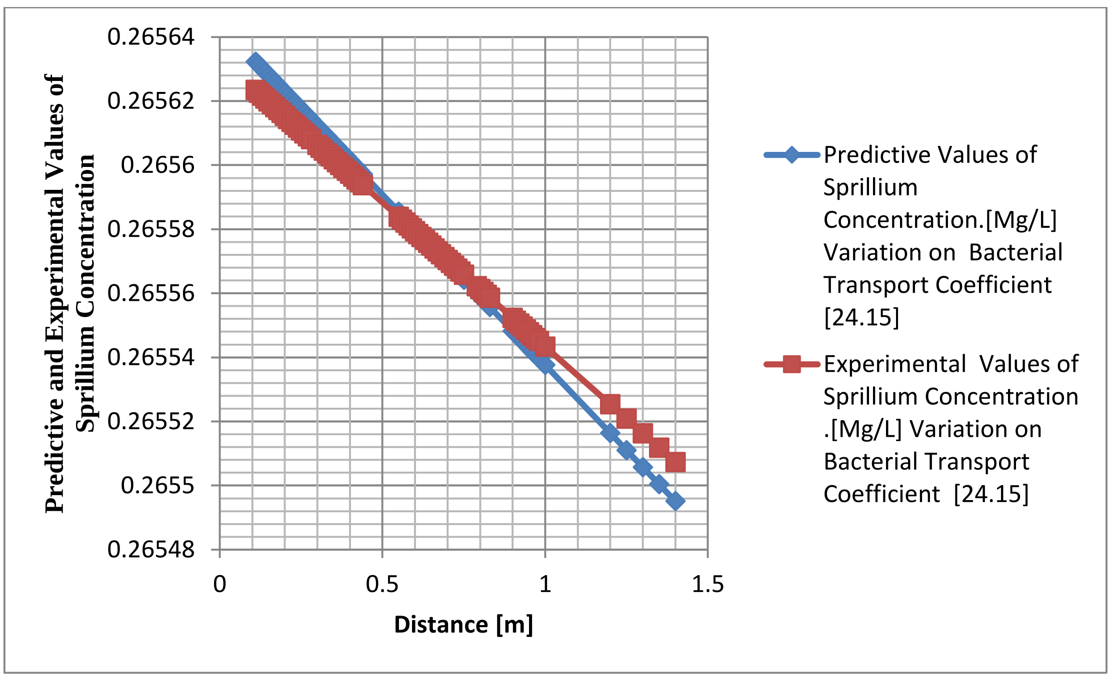

Figure 10: Predictive and Experimental Values of Siprillum Concentration at Different Distance

The graphical representation of the simulation that generated predictive values from figure one to ten has been expressed, these figures explain the system transport process by monitoring the behaviour of the microbes, and these are in terms of migration in concentration at different station point in the stream. These were carried out in the surveyor to investigate the transport process of the microbe at different source of their deposition, it is done through different points of waste discharge in the stream, there rate of fluctuation in terms of concentration at different waste discharge points were thoroughly investigated, such condition were observed in the study, these process generated influential parameters in the study area that thoroughly detailed the behaviour of the microbes, these are through variation in transport and in their heterogeneous microbial population in the streams, the study shows parameters such as heterogeneous velocity of flows in the stream including diffusion and dispersion with bacterial transport coefficient. The study observed that the microbes were predominantly influenced by stream velocity at heterogeneous setting, these

parameters were observed from investigation carried out, it also pressure the system on its development to generated simulation model for the study. The decrease in concentration are attributed to variations of stream velocities at different station point, some other factors in microbial or bacterial growth rate are affect through their interaction that are regulated by the type of concentration available in organic and in organic nutrients, there are based on the types and concentration levels of residual disinfectant, it also includes predators such as protozoa and invertebrates, and that of environmental conditions which includes water temperatures, the system also observed the activities of the microbes influenced from the pH, it also includes that of total phosphorus deposition in the stream, other effect includes climatic conditions, the influential factor of pH influence the degradation of the microbes in terms of decrease with respect to increase in distance.

5. CONCLUSION

The study monitored the transport behaviour of Siprillum in stream at different study locations, the study investigate the streams considering variations of stream velocity of flow based on the rates of discharge of biological waste, these might be noted when their through existence of coliform in water are observed, more so, it includes the activity outside the cell that may definitely become slow enough, these conditions cause osmotic stress whereby the cell cannot take up water and become dominant. The microorganism are not eliminated, but they cannot grow, but the study observed several negative conditions that were noted, which were applied to monitor the migration level of the contaminants in the stream, these are figures that has represent the results from the station point that experience it in all the figures . The dispersions were observed in the study location due to the behaviour experienced from all the graphical representation, this also includes other physical factors that affect the growths of microbes. The study also attributes the decrease in concentration in streams due to the temperature that express the significant in the growth of microbes, whereby it pressure it through its rates of enzyme Catalyzed reaction and rate of growth. These are normally observed in every microbe, these expressed the maximum rate of growth and minimum rates of temperature inhibition, these conditions affect the growth rate of the microbes in the stream, the simulation values were compared with experimental data, and both parameters developed best fits correlation.

Funding

This study has not received any external funding.

Conflict of Interest

The author declares that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Arnone, R.D. and Walling, J.P. (2007) waterborne pathogens in urban watersheds. Journal of Water and Health 5(1), 149-162.
2. Brookes, J.D., Antenucci, J., Hipsey, M., Burch, M.D., Ashbolt, N.J. and Ferguson, C. (2004) Fate and transport of pathogens in lakes and reservoirs. Environment International 30(5), 741-759.
3. Craun, G.F., Fraun, M.F., Calderon, R.L. and Beach, M.J. (2006) Waterborne outbreaks reported in the United States. Journal of Water and Health 4, 19-30.
4. Colwell, R.R. (1996) Global climate and infectious disease: The Cholera Paradigm. Science 274(5295), 2025-2031.
5. Gerba, C.P. and McLeod, J.S. (1976) Effect of sediments on the survival of Escherichia coli in marine waters. Applied and Environmental Microbiology 32(1), 114-120.
6. Gerba, C.P. and Smith, J. (2005) Sources of pathogenic microorganisms and their fate during land application of wastes. Journal of Environmental Quality 34, 42–4
7. Hipsey, M R., Antenucci, J.P. and Brookes, J.D. (2008) A generic, process-based model of microbial pollution in aquatic systems. Water Resources Research 44(7), W07408.
8. Intergovernmental Panel for Climate Change (IPCC) 2007. IPCC Fourth Assessment Report, Summary for Policymakers, p. 5.
9. Jamieson, R., Gordon, R., Sharples, K., Stratton, G. and Madani, A. (2002) Movement and persistence of fecal bacteria in agricultural soils and subsurface drainage water. Canadian Biosystems Engineering 44, 6.1–6.10.
10. Jamieson, R., Gordon, R., Joy, D. and Lee, H. (2004) Assessing microbial pollution of rural surface waters: A

review of current watershed scale modeling approaches. Agricultural Water Management 70(1), 1-17.
11. John, D.E. and Rose, J.B. (2005) Review of factors affecting microbial survival in groundwater. Environment Science & Technology 39(19), 7345-7356.
12. Kay, D., Crowther, J., Stampleton, C.M., Wyer, M.D., Fewtrell, L., Anthony, S., Bradford, M., Edwards, A., Francis, C.A., Hopkins, M., Kay, C., McDonald, A.T., Watkins, J. and Wilkinson, J. (2008) Faecal indicator organism concentrations and catchment export coefficients in the UK. Water Research 42, 2649-2661.
13. Kay, D., Edwards, A.C., Ferrier, R.C., Francis, C., Kay, C., Rushby, L., Watkins, J., McDonald, A.T., Wyer, M., Crowther, J. and Wilkinson, J. (2007) Catchment microbial dynamics: the emergence of a research agenda. Progress in Physical Geography 31(1), 59-76.
14. Pachepsky, Y.A., Sadeghi, A.M., Bradford, S.A., Shelton, D.R., Guber, A.K. and Dao, T. (2006) Transport and fate of manure-borne pathogens: Modeling perspective Agricultural Water Management 86(1-2), 81-92.
15. US Environmental Protection Agency (US EPA) (2012). Impaired waters and total maximum daily loads. http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/index.cfm (accessed on 4.12.11).
16. World Bank (2010) Water Resource Management. Washington, D. C. http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTWAT/0,,contentMDK:21630583~menuPK:4602445~pagePK:148956~piPK:216618~theSitePK:4602123,00.html
17. World Health Organization (2010). Water Sanitation and Healt. http://www.who.int/water_sanitation_health/diseases/en/ (accessed on 6/20/2012).
18. WHO (2011) Millennium Development Goals: progress towards the health-related Millennium Development Goals.